Proton Storage Ring for the ICR Linac

Inoue, Makoto

CITATION:

Inoue, Makoto. Proton Storage Ring for the ICR Linac. Bulletin of the Institute for Chemical Research, Kyoto University 1988, 66(1): 19-21

ISSUE DATE:

1988-03-29

URL:

http://hdl.handle.net/2433/77216

Bull. Inst. Chem. Res., Kyoto Univ., Vol. 66, No. 1, 1988

Proton Storage Ring for the ICR Linac

Makoto INOUE

Received January 18, 1988

A small proton storage ring has been studied for multi-purpose use. The ring is four symmetric and almost isochronous to keep the pulse structure of the injected beam which comes from a 7 MeV-proton linac of the Institute for Chemical Research, Kyoto University. Four quadrupole magnets and an RF cavity are introduced when the beam is manipulated and eventually accelerated in the future.

KEY WORDS: Proton storage ring/ Medical synchrotron/

1. INTRODUCTION

A 7 MeV-proton linac was designed and constructed at the Institute for Chemical Research, Kyoto University[1]. The linac will be completed in 1988 and used for irradiation experiments of material sciences. On the other hand accelerator developments should be done for a future facility using this small linac. We have a future plan to construct a meson factory[2] which consists of an 800 MeV proton linac and some rings including a compressor ring, a synchrotron and other rings. The 7 MeV-proton linac under construction is to be a prototype of a part of the future linac. The high energy section of the future linac was also tested with model cavities[3]. A compressor ring and a synchrotron were proposed[2], and the study of the small ring with an injector of the 7 MeV linac is supposed to be important to develope the future rings. Thus the small ring has been studied for compression, manipulation and acceleration of the beam.

2. LATTICE

An isochronous compressor ring was proposed in the SNQ project[4]. It is useful to reduce the beam loss of extraction which is very important in the case of high intensity machine. But for some other experiments a continuous beam or a pulsed but different micro structure beam is needed. In these experiments, the isochronism is not convenient for manipulation of the beam.

Thus we designed a four sector ring which is almost isochronous. The four bending magnets are basically a part of a separated sector cyclotron. The vertical focusing is obtained by the edge of the sector magnets. The four quadrupole magnets are installed for the correction of the isochronism. The field strength of the quadrupole magnet depends on the energy of the stored beam.

井上 信: Facility of Nuclear Science Research, Institute for Chemical Research, Kyoto University, Kyoto.

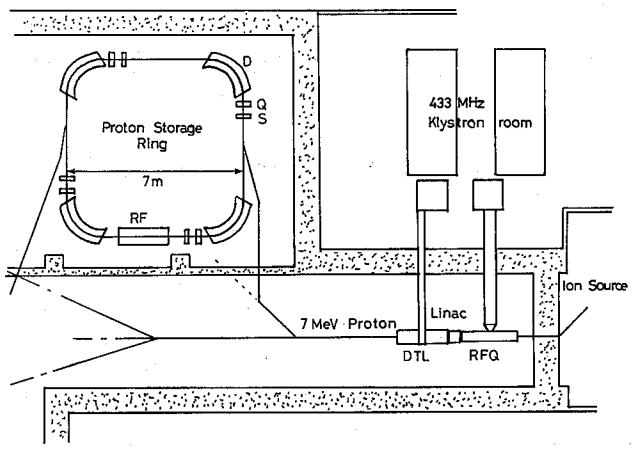

Fig. 1. Plan view of the proposed proton storage ring. The 7 MeV linac will be used as an injector.

Fig. 1 shows a plan view of the concept of the ring. Fig. 2 shows a transition energy of the ring versus quadrupole magnetic fields. If the transition energy is equal to the energy of the stored beam, the ring is isochronous. Fig. 3 shows a diagram of the betatron oscillation. The working point of 7 MeV is stable in the case of isochronous ring. We can also choose stable points in the case of non-isochronous configurations.

3. CONCLUSION

The summary of the designed ring is listed in Table 1. This small ring can be installed at an experimental room of the building of the 7 MeV linac facility.

The author should like to thank 'COSY' group of IKP-KFA-Jülich for their helps to use program MAD during his stay at Jülich.

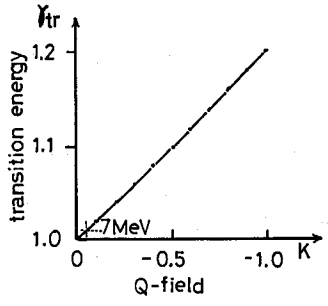

Fig. 2. Quadrupole magnetic field dependence of the transition energy.

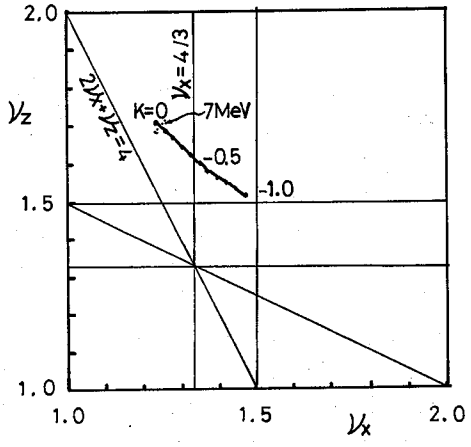

Fig. 3. Tune diagram of the ring.

Table 1.

characteristics of the proton ring	
injection energy	7 MeV
maximum stored energy	200 MeV
cell number	4
focusing	edge focus
betatron frequency	ν_x: 1.2 ~ 1.5
	ν_z: 1.7 ~ 1.5
transitition energy	γ_t: 1.0 ~ 1.2
beta function	β_x: 5 m ~ 2 m
	β_y: 5.5 m ~ 1 m
dispersion	D: ~ 3.3 m
circumference	25 m
applications	1) isochronous pulse compression
	2) pulse structure manipulation
	3) acceleration

REFERENCES

(1) H. Okamoto et al., *Bull. Inst. Chem. Res. Kyoto Univ.*, vol. **65**, no. **1**, 35 (1987).
(2) K. Imai et al., Proc. 5th sym.: Accel. Sci. Tech. 397 (1984).
(3) Y. Iwashita, 1986 Linac Conf. Proc. SLAC Report **303**, 151 (1986).
(4) SNQ. project report, Jül-Spez-113 KFK 3175 (1981).